ORIGINAL ARTICLE

Analysis of quality of life in the medium-long term in bariatric patients using the modified BAROS system

Análisis de la calidad de vida a medio-largo plazo en pacientes bariátricos mediante el sistema BAROS modificado

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Abstract

Objective: *To analyze quality of life (QoL), percentage of excess weight loss (EWL), and resolution of comorbidity using the modified BAROS (Bariatric-Analysis-and-Reporting-Outcome-System) questionnaire.* **Method:** *We used the Moorehead-Ardelt II (M-A II) QoL-questionnaire within the modified BAROS in its Spanish-validated version. This was a single-center ambispec-tive study.* **Results:** *The analysis included 115 patients with a mean follow-up of 7 years post-surgery (SD, 2.11). 48 underwent sleeve-gastrectomy (SG), 67 Roux-en-Y gastric-bypass (RYGB), both laparoscopic. The mean age was 47.65 years (IQR: 27-63) ($p < 0.975$). The average body mass index reduction was 33 kg/m^2 (SD, 6.34). Weight loss: SG 98 kg, RYGB 83 kg ($p < 0.0001$). EWL: SG 22.25% vs RYGB 30.94% ($p = 0.0001$). Comorbidity resolution: 49% ($p = 0.033$), SG 60% vs RYGB 40% ($p = 0.033$). Postoperative complications: 3% (SG 2% vs RYGB 1%). The mean BAROS score was 5.7 points (SD, 2.71), SG 4.7 vs RYGB 6.4 ($p = 0.002$). Excellent or very good outcomes were observed in 70%, with failure rates below 8%. In terms of QoL (M-A II), the area rated as "very good" was work activity (95.45%), while "very poor" was sexual-relationships (18.4%).* **Conclusions:** *Both SG and RYGB show favorable medium- to long-term outcomes in terms of weight loss, comorbidity resolution, and improved quality of life.*

Keywords: *BAROS. Quality of Life. Bariatric Surgery. Obesity.*

Resumen

Objetivo: *Analizar la calidad de vida (CV), el porcentaje de exceso de peso perdido (EWL, effective weight lost) y la resolución de la comorbilidad mediante el cuestionario BAROS (Bariatric Analysis and Reporting Outcome System) modificado.* **Método:** *Se aplicó el cuestionario de CV Moorehead-Ardelt II (M-A II)-BAROS modificado en su versión validada al español. Análisis unicéntrico ambis-pectivo.* **Resultados:** *Se incluyeron 115 pacientes con una media de 7 años desde la intervención (DE: 2.11), con gastrectomía vertical (GV) 48 y 67 con bypass gástrico yeyunal (BPGY), laparoscópicos. La edad media fue de 47.65 años (RIC: 27-63) ($p < 0.975$). La reducción promedio del índice de masa corporal fue de 33 kg/m2 (DE: 6.34). El peso perdido con GV fue de 98 kg y con BPGY de 83 kg ($p < 0.0001$). El EWL con GV fue del 22.25% y con BPGY del 30.94% ($p = 0.0001$). La resolución de comorbilidad se logró en el 49% ($p = 0.033$), el 60% con GV frente al 40% con BPGY ($p = 0.033$). Hubo complicaciones posoperatorias en el 3% (2% con GV y 1% con BPGY). El valor medio de BAROS fue de 5.7 puntos (DE: 2.71), 4.7 con GV frente a 6.4 con BPGY ($p = 0.002$). Los resultados fueron excelentes o muy buenos en el 70%, y el fracaso < 8%. En el apartado de CV (M-A II) correspondiente a «muy buena»: actividad laboral (95.45%); «muy pobre»: relaciones sexuales (18.4%).* **Conclusiones:** *La GV y el BPGY a medio-largo plazo conducen a resultados favorables en términos de pérdida de peso, corrección de comorbilidad y mejoría de la CV.*

Palabras clave: *BAROS. Calidad de Vida. Cirugía bariátrica. Obesidad*

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Introduction

There is a steadily increasing number of individuals with obesity worldwide. In Spain, according to data from the Spanish Ministry of Health and Consumer Affairs (European Health Survey 2020), the prevalence of obesity is 10.3% among individuals aged 2-17 years and 16% among those older than 18 years.

Obesity leads to the development of major comorbidities such as arterial hypertension (HTN), type 2 diabetes mellitus (T2DM), dyslipidemia (DL), obstructive sleep apnea syndrome (OSAS), etc., which also entails significant pharmacological expenditure[1].

The benefits of bariatric surgery are widely demonstrated in the literature, both in terms of excess weight loss percentage (EWL, excess weight loss) and improvement and resolution of comorbidities.

The BAROS questionnaire (Bariatric Analysis and Reporting Outcome System) was developed in 1998 to measure not only weight loss and resolution of comorbidities after bariatric surgery but also to assess quality of life (QoL)[2]. Years later, it was modified to incorporate the Moorehead-Ardelt II QoL survey (modified BAROS)[2,3].

The modified BAROS questionnaire uses a Likert scale from −0.50 to +0.50, combining percentage of weight loss, improvement in medical conditions, postoperative complications, and reinterventions, thereby generating a total score. The higher the score, the better the outcome; a score ≤ 1 is considered failure, whereas > 7 points is considered an excellent result[4,5].

Although several studies have used this tool to measure institutional bariatric QoL outcomes, follow-up duration is usually short, generally 12–24 months[4-6]. For this reason, we considered it appropriate to conduct a medium- to long-term study given the scarcity of such studies, and additionally to compare the two most widely used bariatric techniques worldwide.

The primary endpoint of our analysis using the modified BAROS questionnaire is to evaluate QoL in patients undergoing bariatric surgery by two laparoscopic techniques, sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB), as well as to determine the percentage of EWL and correction of major comorbidities in our hospital center from January 2012 through December 2019.

Method

We conducted a single-center ambispective study of patients who underwent bariatric surgery for obesity between January 2012 and December 2019. Due to the COVID-19 pandemic, these surgeries were suspended in 2020.

During this period, 758 bariatric procedures were performed at our center. Of these, only SG and RYGB were selected, excluding other bariatric procedures, leaving 707 patients. Homogeneous groups of 30 patients per year and per surgical technique were randomly selected.

Patient recruitment began in February 2022 using the QoL questionnaire (BAROS), both by postal mail and by personal delivery in a sealed envelope at the bariatric surgery clinic. Recruitment concluded in June 2023.

Patients were provided with investigators' contact details in case they had questions about the study. Participation was confirmed once the patient returned the signed informed consent form. If questionnaires were not returned within 1 month from initial inclusion, a phone call was made to confirm continued willingness to participate. A second phone call was made 2 weeks later if the questionnaire had not been returned. Participants were excluded if they did not return completed questionnaires 2 months after the second follow-up call. If the individual no longer wished to participate, they were excluded.

A total of 115 patients correctly completed the QoL questionnaire.

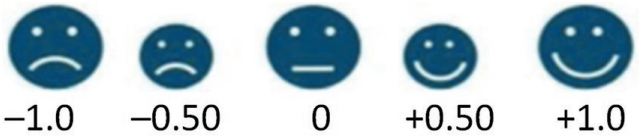
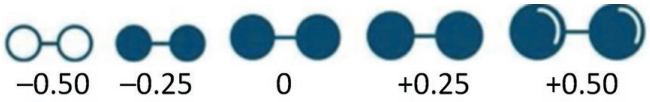
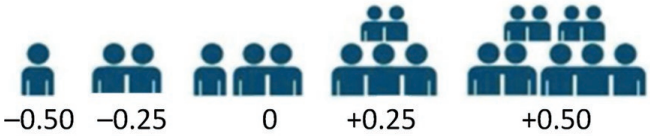
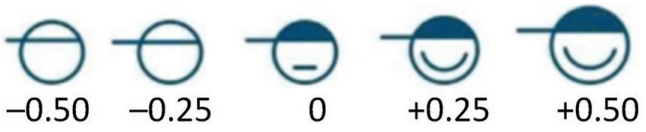
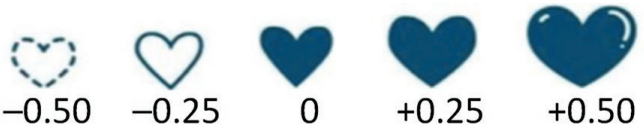
Prospectively, during 2023, long-term objective variables necessary to calculate BAROS QoL were collected. Preoperative and postoperative data (reinterventions and complications) were retrospectively obtained from health records and our database.

The study was approved by the quality and ethics committee of our hospital center, in accordance with its codes and regulations.

All included patients authorized participation by signing informed consent prior to completing the modified BAROS questionnaire (Fig. 1).

The health-related QoL questionnaire (Moorehead-Ardelt II) included in BAROS (Fig. 2) has also been adapted and validated in the Spanish population since 2014[7]. It is a descriptive questionnaire completed by patients or by the investigator during an interview. It evaluates QoL in six domains: self-esteem, physical activity, social relationships, work performance, sexual activity, and relationship with food.

Scoring is performed using a 10-point visual scale guided by graphics corresponding to the level of feeling or satisfaction. The global score is obtained by summing the six parameters and classifies QoL as very poor, poor, good, very good, and excellent. In the

% Excess weight loss (points)	Comorbidity (points)	Quality of life questionnaire
Weight gain (–1)	**Worsened (–1)**	**Self-esteem** 
0–24% (0)	**No change (0)**	**2. Physical** 
25–48% (1)	**Improvement (1)**	**3. Social** 
50–74% (2)	**One major resolved, other improvements (2)**	**4. Work** 
75–100% (3)	**All major resolved, other improvements (3)**	**5. Sexual** 
SUBTOTAL:	**SUBTOTAL:**	**SUBTOTAL:**
Complications:	**Minor: subtract 0.2 points Major: subtract 1 point**	
Recovery	**Subtract 1 point**	
TOTAL score:		

FINAL EVALUATION

Without comorbidity	With comorbidity
Failure 0 or less	**Failure** 1 or less
Fair > 0 to 1.5	**Fair** > 1 to 3
Good > 1.5 to 3	**Good** > 3 to 5
Very good > 3 to 4.5	**Very good** > 5 to 7
Excellent > 4.5 to 6	**Excellent** > 7 to 9

Figure 1. *BAROS questionnaire.*

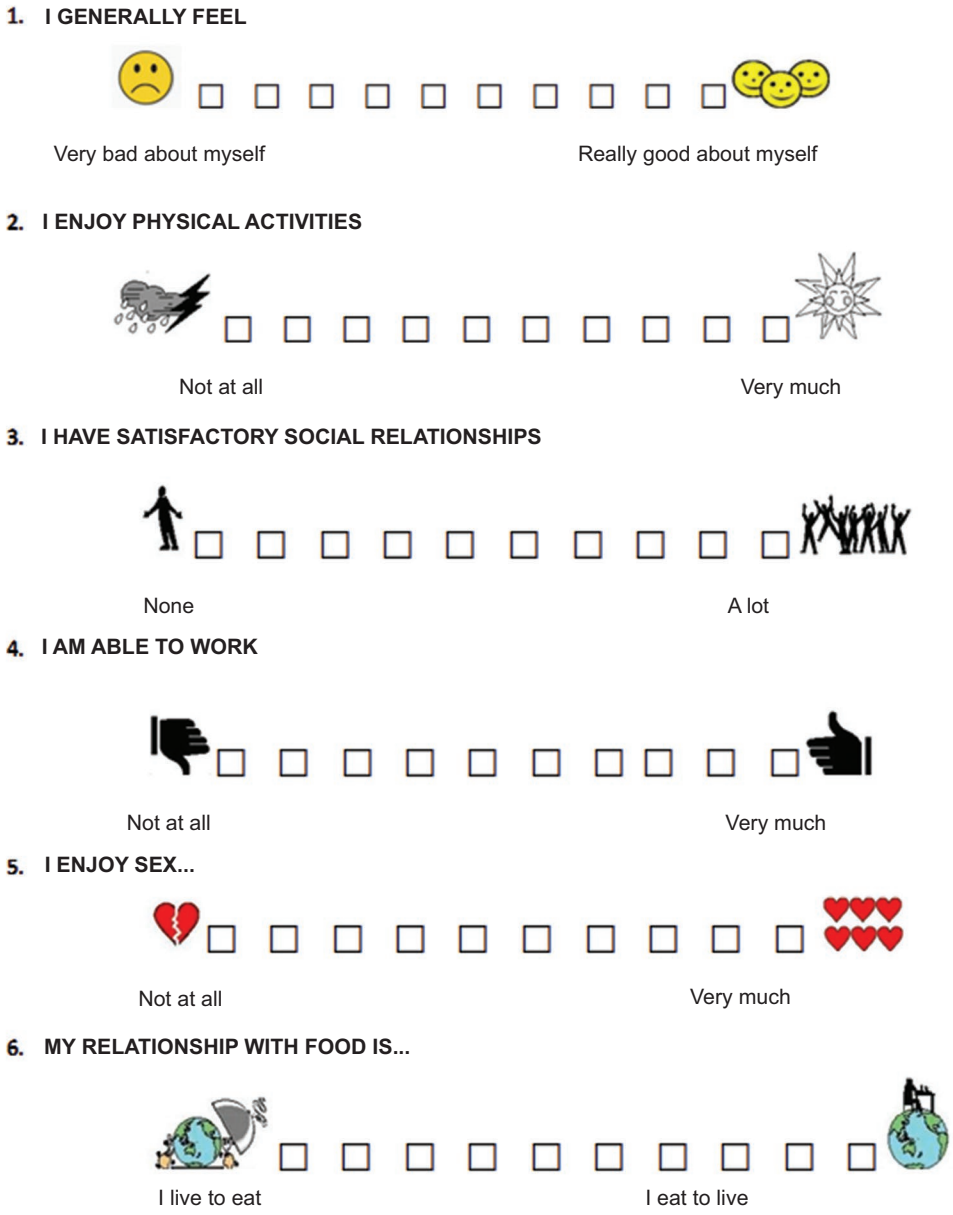


Figure 2. *Modified BAROS QoL questionnaire – Moorehead-Ardelt II (M-A II).*

case of a major complication requiring reintervention, only one point is deducted from the modified BAROS questionnaire.

Selected patients, aged 18-63 years, underwent laparoscopic SG or RYGB.

RYGB was indicated in patients with body mass index (BMI) between 40 and 49.9 without metabolic alterations and > 35 with metabolic alterations (mainly T2DM). Gastric reservoir capacity was 50-60 ml calibrated with a 36-Fr Faucher tube. Gastrojejunal anastomosis was performed using a circular mechanical DST 25 mm technique according to the modified Whittgrove technique with an EEA OrVil, Covidien™ device[8]. In other patients a linear mechanical anastomosis was performed according to the Lönroth technique[9].

SG was indicated in patients with BMI > 50 or between 35 and 39.9 in the absence of metabolic pathology, without symptoms of gastroesophageal reflux disease and without grade B-C esophagitis according to the Los Angeles classification on prior endoscopy.

Table 1. Clinical and demographic variables

Variables	SG (n = 48)	RYGB (n = 67)	Total (n = 115)	p
Women	33 (69%)	47 (70%)	80 (70%)	0.872
Age, years	47.81 (8.29)	47.70 (7.88)	47.75 (8.02)	0.975
BMI, kg/m^2	47.24 (8.04)	44.91 (5.72)	45.88 (6.85)	0.094*
Weight, kg	128.07 (23.97)	121.66 (19.03)	124.33 (21.37)	0.158
Comorbidity	44 (92%)	65 (97%)	104 (95%)	0.198
HTN	31 (65%)	33 (49%)	64 (56%)	0.103
T2DM	10 (21%)	51 (76%)	61 (53%)	0.000*
DL	13 (27%)	30 (45%)	43 (37%)	0.053*
OSA	37 (77%)	43 (64%)	80 (70%)	0.138

*Statistical significance.
RYGB: jejunal gastric *bypass*; DL: dyslipidemia; T2DM: type 2 diabetes *mellitus*; SG: sleeve gastrectomy; HTA: hypertension; BMI: body mass index; OSA: obstructive sleep apnea syndrome.
Quantitative variables are expressed as mean and qualitative variables as n (%).

Table 2. Medium- to long-term variables

Variables	SG (n = 48)	RYGB (n = 67)	Total (n = 115)	p
Time since intervention, years	6.85 (2.09)	6.60 (2.13)	6.70 (2.11)	0.521
BMI, kg/m^2	35.55 (6.92)	30.56 (4.98)	32.64 (6.34)	0.521
Weight, kg	97.77 (21.98)	83.25 (16.22)	89.31 (20.08)	< 0.0001*
EWL, %	22.25 (12.18)	30.94 (11.30)	27.31 (12.40)	0.0001*
Comorbidity	29 (60%)	27 (40%)	56 (49%)	0.033*
HTN	23 (48%)	16 (24%)	39 (34%)	0.007*
T2DM	7 (15%)	12 (18%)	19 (17%)	0.639
DL	11 (23%)	9 (13%)	20 (17%)	0.186
OSA	12 (25%)	6 (9%)	18 (16%)	0.020*

*Statistical significance.
RYGB: Roux-en-Y gastric bypass; DL: dyslipidemia; T2DM: type 2 diabetes mellitus; EWL: excess weight loss (%); GV: sleeve gastrectomy; HTN: hypertension; BMI: body mass index; OSA: obstructive sleep apnea syndrome.
Quantitative variables are presented as mean, and qualitative variables as n (%).

Variables

Variables analyzed included demographic data, BMI (kg/m^2), initial and postoperative weight (kg), percentage of EWL, and major comorbidities (HTN, T2DM, DL, OSAS).

Other bariatric surgical techniques different from SG and RYGB were excluded.

Statistical analysis

Descriptive statistics were performed. Measures of central tendency (mean) and dispersion (standard deviation [SD]) were calculated for quantitative variables, and absolute and relative frequencies for qualitative variables.

To detect differences between techniques, χ^2 test (or Fisher's exact test in the absence of normality) and Student's t-test (or Mann-Whitney nonparametric test in the absence of normality) were applied. Normality was assessed using the Shapiro-Wilk test.

Spearman's correlation coefficient was calculated between time elapsed since surgery and BAROS score to detect a linear relationship. A value of $p \leq 0.05$ was considered statistically significant.

All analyses were performed using Stata Statistical software (14.2 College Station, TX: StataCorp LLC 2016).

Results

A total of 115 patients were included. Clinical and sociodemographic characteristics are shown in table 1. Seventy percent were women; mean age was 47 years (SD, 8.02); mean initial BMI was 46 (SD, 6.85); and mean initial weight was 124 kg (SD, 21.37). Only 5% had no comorbidity prior to surgery. No significant differences were found between techniques for baseline variables, except for T2DM, which was higher in the RYGB group.

Mean follow-up was 7 years (SD, 2.11), similar between techniques. Follow-up exceeded 5 years in nearly 80% of patients. BMI decreased to a mean of 33 (SD, 6.34), and weight decreased to 89 kg (SD, 20.08), with significant differences between SG and RYGB: 98 kg vs. 83 kg ($p < 0.0001$).

Comorbidity decreased to 49% of patients postoperatively, with significant differences between SG and RYGB: 60% vs. 40% ($p = 0.033$) (Fig. 3 and Table 2).

Medical conditions improved in 88% of patients, worsened in nearly 9%, and remained unchanged in 3%.

Only 3 patients (2 SG and 1 RYGB) had complications requiring reintervention.

Mean BAROS score was 5.7 points (SD, 2.71), with significant differences between techniques: SG 4.7 vs. RYGB 6.4 ($p = 0.002$). Nearly 70% of patients had excellent or very good results, with failure < 8% (Fig. 4).

A moderate negative correlation was found between time since surgery and BAROS score ($\rho = -0.2279$;

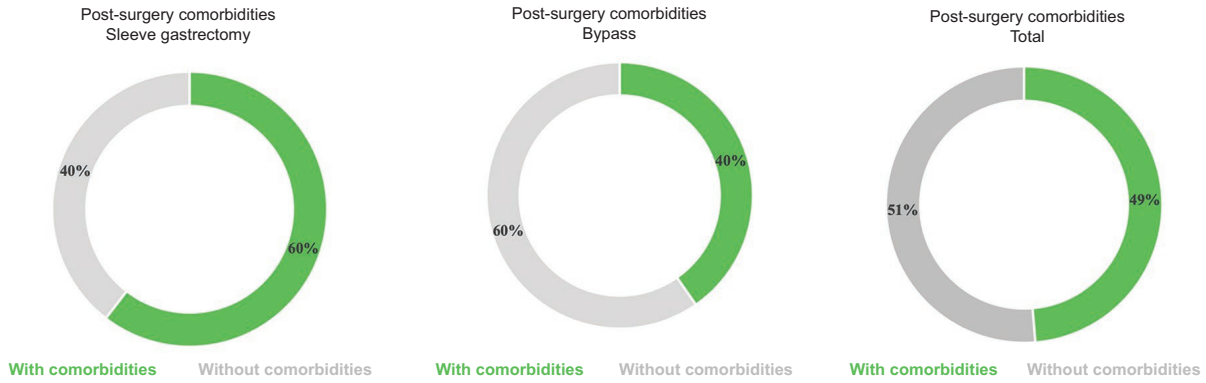


Figure 3. *Medium- to long-term postoperative comorbidity.*

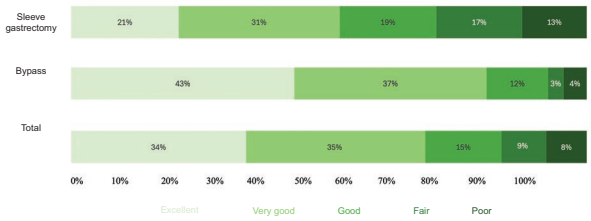


Figure 4. *Postoperative BAROS and M-A II results.*

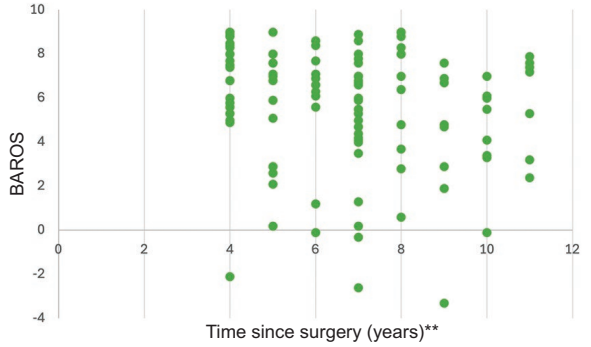


Figure 5. *Time since intervention and correlation with BAROS results.*

p = 0.0143), meaning that longer time since surgery was associated with lower BAROS score. Graphically, this correlation is difficult to appreciate (Fig. 5).

Among patients reporting excellent QoL after surgery: work activity 95.45%, social relationships 83.95%, self-esteem 78.2%, sexual relationships 72.45%, relationship with food 59.8%, and physical activity 51.75%. Among those reporting very poor QoL: sexual relationships 18.4%, work 10.35%, physical activity 8.05%, relationship with food 6.9%, social relationships 3.45%, and self-esteem 2.3%.

Discussion

Bariatric surgery has demonstrated reduced mortality through total or partial resolution of comorbidities, as well as improved QoL and prolonged life expectancy, even with modest initial weight reduction.

The modified BAROS questionnaire and the M-A II QoL survey are useful tools for analyzing obesity-related pathologies and QoL perception across self-esteem, social relationships, work capacity, physical activity, sexual relationships, and relationship with food, regardless of surgical technique[10].

The 2004 Consensus of the Sociedad Española para el Estudio de la Obesidad and Sociedad Española de Cirugía de la Obesidad (SEEDO–SECO), based on Reinhold and MacLean, categorizes weight loss outcome as excellent if BMI < 30 and EWL > 75%, good if BMI 30-35 and EWL 50-75%, and failure if BMI > 35 and EWL < 50%[11].

Short-term studies (12–24 months) or those with small sample sizes often report excellent results, even using QoL questionnaires other than BAROS[12].

González et al.[13] and Queiroz et al.[14] reported excellent short-term results of 67 and 74.6% at 12 months, respectively.

Our main findings show that, at a mean of 7 years after SG or RYGB, most patients maintain weight loss, reduce comorbidities, and improve QoL – particularly work capacity and self-esteem – with a low complication rate (3%). These findings are consistent with long-term studies including various bariatric techniques[13-15].

Outcomes tend to worsen 3-5 years postoperatively due to weight regain or recurrence of comorbidities, directly affecting QoL[15-17].

Few medium- to long-term (> 5 years) studies using BAROS and M-A II report good to excellent results. In our analysis, SG achieved good to excellent results in 71% and failure in 13%, while RYGB achieved good to excellent results in 80% with 4% failure.

When analyzing the reduction of comorbidity by comparing both techniques, a greater correction of T2DM was observed in favor of RYGB, and this difference was statistically significant. This result may be explained by the fact that most of our patients who underwent this technique had T2DM prior to surgery, which was not the case with SG.

Himpens et al.[18,19] retrospectively studied 77 patients who underwent RYGB, obtaining a mean BAROS score of 2.0 ± 1.96 points (fair) at 9 years, and when evaluating SG outcomes at 6 years, they obtained a mean BAROS score of 5.0 ± 2.7 points (good/very good)[18,19].

A study conducted in our country including 353 patients (303 RYGB and 50 SG) with a mean follow-up of 5.7 ± 2.6 (2.0-11.7) years reported a BAROS score of 4.35 ± 2.06 (good/very good); in 84.7%, outcomes regarding comorbidity resolution were good to excellent, and the M-A II score was 1.51 ± 0.93, with 67.2% of patients reporting good or very good QoL[20].

Thus, the main strength of our study lies in the fact that medium- and long-term QoL in our patients ranges from good to excellent, with a mean BAROS score of 5.7 points (SD, 2.71), and additionally compares the two most widely used surgical techniques worldwide. These results fall within the quality standards established for this type of study, taking into consideration the limited number of medium- to long-term studies currently available.

Keren et al.[21] in a study of 114 patients who underwent bariatric surgery observed a clear worsening of outcomes at 60 months compared with those detected at 30 months. EWL decreased from 76.8 kg to 45.3 kg, the BAROS score from 7.15 ± 0.8 to 4.32 ± 0.9, and the percentage of weight-loss success from 70.17% to 28.07%.[21] Based on these findings, we considered it appropriate to include the linear correlation coefficient in our statistical analysis in order to obtain data correlated with the time elapsed since surgery.

One limitation of our study is the subjectivity of the QoL questionnaire, since weight losses lower than those considered optimal may nevertheless be sufficient for patients if they perceive improvement in QoL and comorbidity.

Conclusions

We believe that our study meets its objectives in most of our patients at medium- to long-term follow-up. We can affirm that the bariatric surgery techniques used are safe and effective for weight loss and for the resolution or improvement of major comorbidity, as well as for improving QoL across its six evaluated parameters.

There are other factors related to the mental domain that the modified BAROS does not assess and that may not improve as markedly after bariatric surgery, such as worsening QoL following progressive weight regain beyond 24 months after surgery.

Therefore, further medium- to long-term studies are needed to obtain more precise results regarding QoL and comorbidity correction after bariatric surgery, in accordance with the time elapsed since the surgical intervention.

Funding

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Conflicts of interest

The authors declare no conflicts of interest.

Ethical considerations

Protection of human and animal subjects. Procedures followed ethical standards of the responsible human (or animal) experimentation committee, in accordance with the World Medical Association and the Declaration of Helsinki. Authorized by the institution's Ethics Committee.

Confidentiality, informed consent, and ethical approval. Institutional protocols were followed for access to clinical data. Informed consent was obtained. SAGER guidelines were followed.

Declaration on the use of artificial intelligence (AI). No generative artificial intelligence was used.

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